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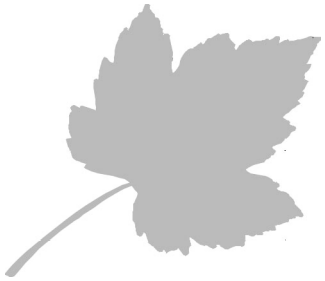

Selecting and Planting Landscape Trees

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UNIVERSITY
EXTENSION

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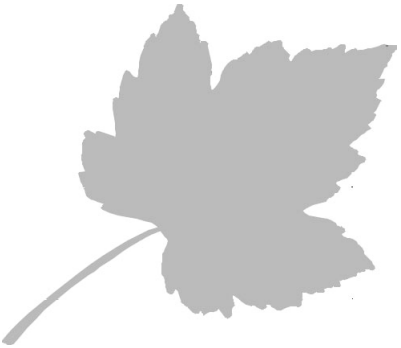


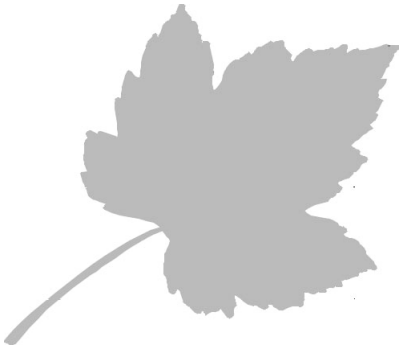
INTRODUCTION

Trees and shrubs are a valuable addition to most property. Properly planted, well maintained trees add beauty, wind protection, shade, wildlife habitat, visual screening, and other benefits to the landscape.

Unfortunately, many landscape trees are not properly planted or cared for. In some cases this is simply a matter of neglect, but in other cases the person planting or caring for a tree is not properly trained. Recent research findings have led to improved methods for planting and maintaining trees that are often very different from traditional methods. In some cases we have found that traditional methods have actually done considerable harm.

Planting techniques have received considerable attention in recent years. Increased awareness about tree root systems, soils, and the effects of planting on both, have led to new recommendations on planting depth, soil amendments, fertilization, and tree handling. In this publication we describe how to select a tree and the most up-to-date techniques for planting landscape trees and for post-planting care. Recommendations are based on research where possible, though many questions about tree planting have not yet been answered by researchers. We will update this publication as new information becomes available.

This second edition updates the first edition published in February 1995. Extensive changes have been made to the tree selection guide, including the addition of many new species and cultivar names for each species.



TREE SELECTION

In selecting a tree species or cultivar – a species is a particular type of tree, like a Norway maple; a cultivar is a cultivated variety of a species selected for certain characteristics, like a 'Crimson King' Norway maple – our goal should be to have a tree well-matched to its planting site so it survives and thrives. The tree must also achieve our goals for size, shape, function, and appearance and must be affordable. Unfortunately, people usually only pay attention to visually obvious characteristics like flower color, presence or lack of fruit, and crown shape or size. Though such characteristics may be important, they usually have little to do with whether the tree will do well on its planting site. Lack of knowledge of a tree's site-related needs results in disappointed tree owners and a lack of well-adapted trees in our landscapes.

A tree's site-related needs and its ability to withstand environmental extremes are rooted in its native origins. All landscape tree species and cultivars were once native to a certain climatic or geographic region or have been bred from native trees. These native trees were well-adapted to their surroundings and these adaptations usually carry over into the cultivated trees we see (with the exception of some species like fruit trees that have undergone intensive breeding). For example, though a white fir (*Abies concolor*) at a nursery may have been grown in a nursery in bright sunlight, it still has its native characteristic of shade tolerance that allows it to seed-in under the shade of a forest canopy. Cottonwoods (*Populus* species) are native to bare river flood plains which helps explain their preference for moist soils and bright light. Though you may not know much about a particular tree's native habitat, remember that trees have specific site requirements that vary between species and cultivars. Matching your site conditions to a tree that you like is the key to tree selection. Several factors that should be considered in matching a tree to your site are described on the following pages.

SOIL CONDITIONS
Soil provides trees with physical support, water, mineral elements (sometimes called nutrients), and oxygen for the roots. Certain properties, such as soil pH (alkalinity or acidity), drainage, density or compaction, texture, salinity, and structure affect a soil's ability to provide these benefits to trees. Modification of these properties at planting time may be possible and will be discussed later.

COLD AND HEAT TOLERANCE
Some trees are very cold hardy and withstand extremely cold temperatures, while others are killed by a mild frost. In some cases a tree may be fairly cold hardy while dormant but may become active too early in the spring and suffer damage by a late frost. Other species may be able to tolerate very high temperatures and some withstand both extreme cold and heat quite well. Plant hardiness zones indicating average annual minimum temperatures have been developed by the U.S. Department of Agriculture and are shown for Utah on page 11. A detailed map of these zones for Utah is available from the Utah Climate Center at Utah State University or at www.ars-grin.gov/ars/Beltsville/na/hardzone/ushzmap.htm.

SHADE TOLERANCE
A tree's shade tolerance can vary from very intolerant to very tolerant and is important if you have a very shaded or very open planting site. Shade intolerant trees rarely do well in shaded areas. Though shade tolerant trees do best in at least partial shade, some also do well in sunny locations.

WATER REQUIREMENTS
Some tree species are very drought tolerant and can grow in near-desert conditions, while others need access to abundant water at all times. Many heat tolerant species are also drought tolerant. In much of the populated area of Utah, including the Wasatch Front, precipitation does not provide enough water for the needs of many of the trees we plant. Irrigation is necessary on such sites in most years for all but the most drought tolerant trees. However, trees also can be weakened or killed by over watering

PEST RESISTANCE
Some tree species or cultivars are highly susceptible to insect or disease pests while others are nearly pest-free. For example, Lombardy poplar (*Populus nigra* 'Italica') is very susceptible to a stem canker and is almost certain to die within 5 to 15 years. Ginkgo (*Ginkgo biloba*), on the other hand, has few known pests and is also very pollution tolerant. Serious, life-threatening pests like borers and cankers deserve much more attention and concern than late-season leaf feeding insects or other non-life-threatening pests. Stressed trees are often much more susceptible to pest attack and damage.

GROWTH RATE

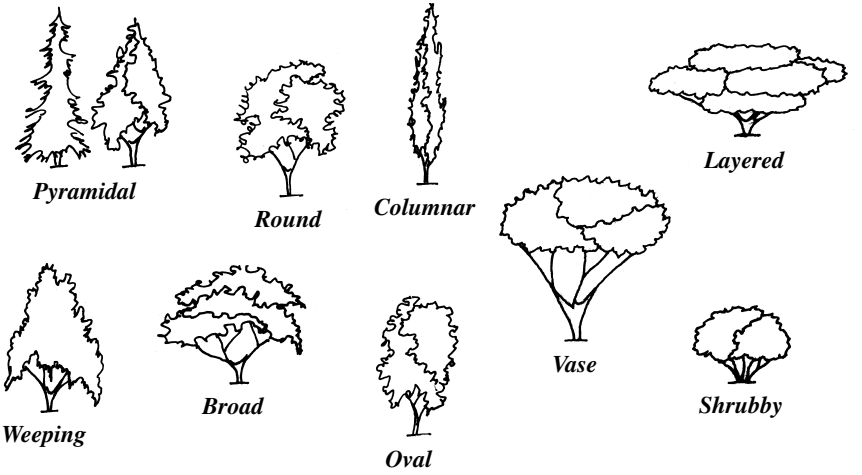
Fast growth rate is one of the main interests people have when selecting a tree. Cottonwoods (*Populus* species) and silver maples (*Acer saccharinum*) can grow many feet in height a year and quickly become large trees. Such fast-growing trees, however, are often short-lived, weak wooded, or quickly outgrow their site. Though planting of some fast-growing trees to quickly establish a landscape may be fine, some slower-growing but longer-lived and more desirable trees should also be planted.

CROWN SIZE

Choose a tree with a mature size that matches the space you have available. Only short trees should be planted near overhead obstructions like power lines (a service line to an individual home is of less concern than a line that feeds several homes or a neighborhood). Strong-wooded tree crowns can be allowed to overhang a roof, but weaker trees should be planted about one-half of their mature crown width away from a building. Trees in groups can be planted close enough that their crowns overlap when they are older, but avoid over-crowding that will lead to poor growing conditions and unhealthy trees.

FORM

Tree species and cultivars vary widely in form or crown shape, depending on their branching pattern. Crowns can be tall and narrow (columnar), short and wide, weeping, round, conical, or vase-shaped. Some trees keep their lower branches and foliage as the crown grows (for example junipers (*Juniperus* species), spruces (*Picea* spp.), true firs (*Abies* spp.)) while others readily lose their lower branches as they are shaded from above (for example most pines (*Pinus* spp.), cottonwoods, elms (*Ulmus* spp.)). Preferred crown form is a matter of personal taste, but crown form also may be an important factor in matching a tree to a site or to the function it will serve. For example, columnar trees are useful in narrow areas, trees used in windbreaks and visual screens need to retain their lower branches and foliage, and sidewalks and driveways should not be obstructed by low or weeping branches.



Tree shape varies widely and is an important consideration when selecting a species or cultivar. Common shapes include pyramidal, rounded, columnar, weeping, broad, oval, vase-shaped, layered, and shrubby.

ROOTING AREA OR VOLUME

Below-ground space for roots is as important as above-ground space for crowns. Though no firm formula exists for calculating the soil area or volume needed for a certain sized tree, figures have been reported of up to 1,600 square feet of soil surface area needed to eventually grow a 20 inch diameter tree (assuming a good soil one foot deep). This area can be of any shape and long narrow areas can be used to connect larger open areas to achieve adequate rooting space. Soil conditions under paved areas often are unfavorable for root growth, though roots can grow along cracks or in voids under pavement and can do quite well under paving bricks or blocks.

LONGEVITY

The typical life span of a good tree in a suburban neighborhood is 30 to 50 years, while downtown trees may only last 5 to 10 years. As mentioned previously, people tend to plant fast-growing trees that often have fairly short lives. While some of this is alright, homeowners and communities should also plant trees that might grow slower but that are longer-lived.

ORNAMENTAL CHARACTERISTICS

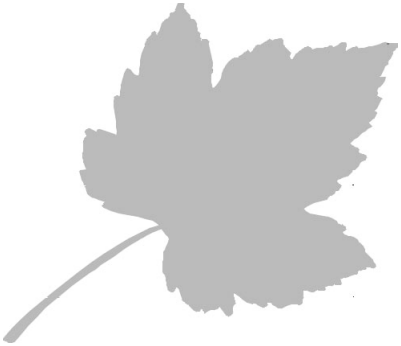
Ornamental characteristics are important factors in tree selection, though they usually have little to do with whether a tree can do well on its site. Ornamental factors include flower and fruit presence and appearance, foliage color and texture, bark characteristics, shade density, fall color, and winter appearance. Some trees have thorns or spines, objectionable odors, a tendency to have basal or root sprouts, or maintenance-related needs that should also be considered.

UTILITY LOCATIONS

Be particularly cautious about the location of overhead and underground electric lines when selecting a planting site and a tree species or cultivar. Only very short trees should be planted under or directly adjacent to overhead electric lines. Medium height trees should be offset 15 to 20 feet horizontally from electric lines and large trees should be offset 30 feet. Wider-crowned trees like elms or maples (*Acer* spp.) should be offset more than narrower-crowned trees like spruces or firs. If you suspect that you are planting in an area with underground electric lines or other buried utilities, call Blue Stakes at 1-800-662-4111 (532-5000 in Salt Lake City area) to have these utilities located and marked. For more information obtain a copy of "Trees and Power Lines," a brochure available from your county Cooperative Extension office or from Utah Power.

INFORMATION SOURCES

Knowledge of a tree's site-related needs, as well as its ornamental characteristics, can be gained through publications, by visiting with a local nursery or arborist, or through your local Cooperative Extension office. *Trees of Utah and the Intermountain West* is a book that covers identification, cultural characteristics, and ornamental features of 219 tree species native and introduced to Utah. It is available in many bookstores, through Utah State University Press (www.usu.edu/~usupress/) and through other outlets such as Amazon.com. A walk through a neighborhood or park with mature trees and similar site conditions to yours can also be helpful. Remember, though, that site conditions, and particularly soil conditions, can vary greatly within a neighborhood or even within a residential lot. Also, some species tolerate a wide range of environmental conditions while others have very narrow, specific requirements.



TREE SELECTION GUIDE

The table on the next several pages summarizes a great deal of tree selection information for Utah. Nearly all trees that are commonly planted plus many that are fairly rare are included. All native trees also are included, since many of these may make good landscape plants but are rarely planted. The information included in this table is based on the knowledge of the authors or has been obtained from reliable sources. Little cultural information exists for some species, however. If you have experience growing any of these trees, particularly those that are less commonly planted, we welcome your input.

USING THIS GUIDE

This tree selection guide is divided into broadleaved trees, most of which are deciduous, and coniferous trees, most of which are evergreen. The characteristics in the table generally are for the species or most commonly planted cultivar, though some species show a wide range in characteristics between cultivars. Cultural characteristics, mostly involved with site selection and planting, along with some comments and limitations, are shown on the left. General species characteristics and ornamental features are shown on the right, along with some common cultivars. A detailed description of table information and symbols follows:

■ Species are listed alphabetically by Latin name in italics, followed by common name(s).

■ (❖) in front of the name indicates a tree native to Utah.

■ (†) indicates a tree that rarely should be planted, though limited use in specific situations may be justified.

■ Tolerance of poor drainage (flooded or compacted soils with low oxygen availability), drought (lack of water), alkalinity (high soil pH; higher than 6.5 to 7), salt (mainly referring to salt spray or deposition on tops, though this may indicate some tolerance to soil salinity), and shade (lack of sunlight) is indicated by the letters **L**(ow), **M**(edium), or **H**(igh).

■ Ease of transplanting also is indicated as **L**(ow), **M**(edium), or **H**(igh). Low ease of transplanting indicates plants that must be especially well-cared for during and after the transplanting process. Such trees often do better when their size at transplanting is small.

■ USDA plant hardiness zones are given to indicate a plant's cold-hardiness, but also give some indication of heat tolerance. The contiguous United States and southern Canada have been divided by the USDA into eleven zones that correspond to a 10°F range in average annual minimum temperatures (see map on page 11). Annual average minimum temperatures for each zone are as follows:

Zone 1 – below -50°F	Zone 5 – -20 to -10°F	Zone 9 – 20 to 30°F
Zone 2 – -50 to -40°F	Zone 6 – -10 to 0°F	Zone 10 – 30 to 40°F
Zone 3 – -40 to -30°F	Zone 7 – 0 to 10°F	Zone 11 – 40°F and above
Zone 4 – -30 to -20°F	Zone 8 – 10 to 20°F	

Utah's hardiness zones range from zone 3 in eastern Rich County, to zones 5 and 6 in the Salt Lake City area and most of the rest of the state at lower elevations, to zone 7 in southern Utah and even zone 8 in the Glen Canyon and St. George areas. Species should only be planted beyond their recommended zones on a trial basis.

■ Comments and limitations are referred to by number and are defined as:
1 – May be insect and/or disease prone, especially when stressed.
2 – Weak wood and/or branch structure.
3 – Fruit and/or plant parts can be nuisances; use fruitless varieties if possible.
4 – Thorns or spines that can be dangerous; use thornless varieties if possible.
5 – Sucker (sprout) growth can be a problem.
6 – Prefers abundant water, but some of these species may survive on a drier site.
7 – Evergreen broadleaf (retains its leaves for more than one year).
8 – Deciduous conifer (loses its needles every year).

■ Growth rate refers to height growth for the first ten years after a tree is planted and is shown as follows: **L**ow – <12 inches/year; **M**edium – 12-24 inches/year; **H**igh – >24 inches/year.

■ Mature height will vary considerably by cultivar and site and is shown here for the species assuming adequate care: **L**ow – <20 feet; **M**edium – 20-40 feet; **H**igh – >40 feet.

■ Longevity refers to the average life span of a tree and may be much shorter on harsh sites or where the species is poorly adapted. Longevity is shown as: **L**ow – <25 years; **M**edium – 25-50 years; **H**igh – >50 years.

■ Trees that are suitable for planting under or near most powerlines are indicated by a check (✓) in that column. This means that their mature height is under about 25 feet. A star (✻) in the power line column indicates that certain, usually dwarf, cultivars are suitable under powerlines, while others are not. Be careful to check cultivar heights when buying. If in doubt, contact your Extension Agent or your electricity provider.

■ Crown shape varies considerably by cultivar and sometimes by site. The common crown shape for a species is shown as follows: **B**road, **C**olumnar, **I**rregular, **L**ayered, **O**val, **P**yramidal, **R**ound, **S**hrubby, **V**ase, **W**eeping.

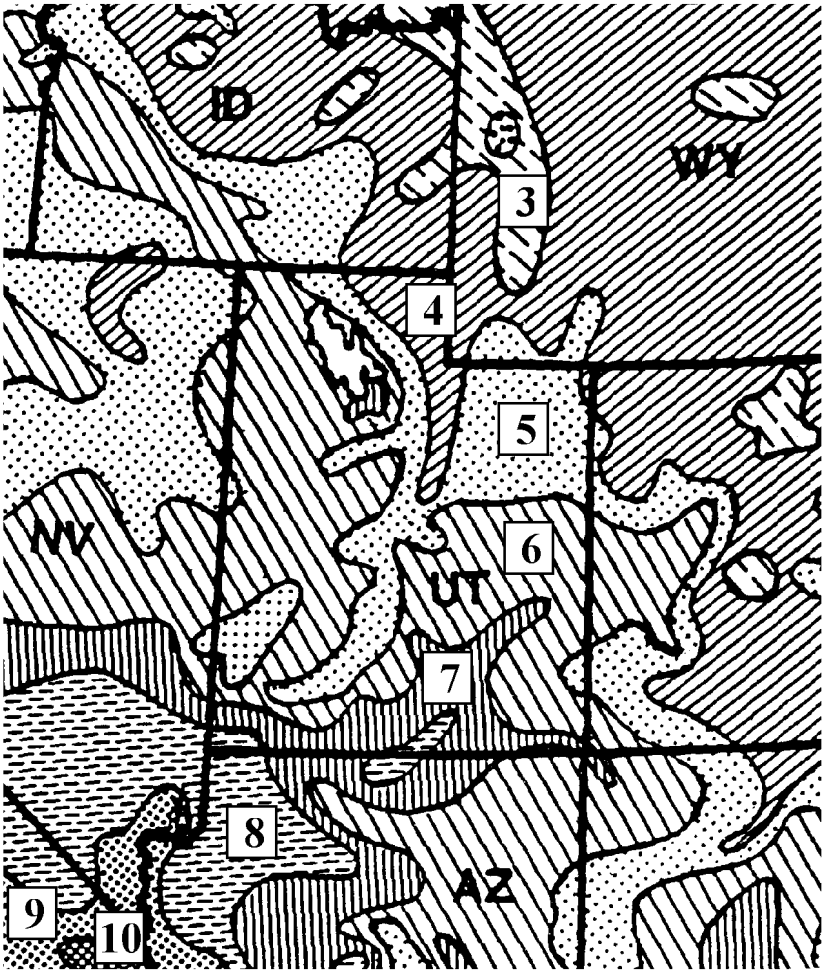
■ The availability of cultivars for a species is indicated in the last column. A few noteworthy cultivars are listed for each species where available, with a note about the cultivar's distinguishing characteristic(s). Some common cultivar names and their meanings are:

'Aurea' or 'Aureum' – golden or yellow leaves during the growing season
'Columnaris' or 'Columnare' – very tight, columnar crown
'Compactum' or 'Nana' – dwarf or small-crowned
'Fastigiata' – narrow crown form
'Glauca' – foliage with a whitish or silvery cast, usually due to a white waxy coating
'Globosa' or 'Globosum' – globe-shaped crown
'Laciniata' or 'Laciniatum' – "cut" or deeply lobed leaves
'Pendula' or 'Pendulum' – pendulous branches or weeping crown shape
'Purpurea', 'Atropurpurea', or 'Atropurpureum' – purple leaves in growing season
'Umbraculifera' – umbrella-shaped crown
'Variegata' – variegated leaves showing multiple colors

Keep in mind that this is only a partial listing, and cultivars often exist with much different characteristics from the original species. Even where named cultivars don't exist, it is important to know the seed source or seed collection location for the tree you are planting. Choose species or seed sources from locations as similar as possible to your planting site. A few of the species listed here would not be found at all outside of extreme southern Utah.

Finally, remember that cultivars can be interesting and unique, but don't ignore the value of the original species. For example, typical native trees of the species American linden (*Tilia americana*) in many ways are better than any of the cultivars that have been selected.

USDA Plant Hardiness Zones



Range of Average Annual Minimum Temperatures for Each Zone

Zone 2	**-50 to -40°F**	**Zone 7**	**0 to 10°F**
Zone 3	**-40 to -30°F**	**Zone 8**	**10 to 20°F**
Zone 4	**-30 to -20°F**	**Zone 9**	**20 to 30°F**
Zone 5	**-20 to -10°F**	**Zone 10**	**30 to 40°F**
Zone 6	**-10 to 0°F**		

Cultural Characteristics								Tree Selection Guide	General Species Characteristics									Available Cultivars
Tolerant of														Orn. Features				
Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments		Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Flowers	Fruit	Fall Color	Bark	Foliage	
Conifers (mostly evergreen)																			
L	M	M	M	H	M	1-5		❖*Abies lasiocarpa* — subalpine or alpine fir	L	H	H		P					✔	None available
L	M	M	M	M	M	3-7		❖*Abies concolor* — white or concolor fir	L	H	H		P					✔	‘Candicans’ (long, blue needles; narrow crown), ‘Compacta’, ‘Violacea’ (silver-blue needles)
M	M	H	M	M	M	5-8		*Calocedrus (Libocedrus) decurrens* — incense-cedar	M	H	H		P		✔		✔	✔	‘Aureo-Variegata’ (yellow-variegated), some columnar forms available
L	M	M	M	M	L	6-9		*Cedrus atlantica* — Atlas cedar	L	H	H		P		✔		✔	✔	‘Argentea’ (silver-blue), ‘Aurea’ (yellowish), ‘Fastigiata’, ‘Glauca’, ‘Glauca Pendula’
L	M	M	M	L	H	7-9		*Cedrus deodara* — Deodar cedar	M	H	H		P		✔		✔	✔	‘Kashmir’ (cold hardy to -5°F), ‘Shalimar’ (cold hardy to -15°F; good blue-green color)
L	M	M	M	L	M	5-7		*Cedrus libani* — cedar of Lebanon	L	H	H	✻	P		✔		✔	✔	‘Argentea’ (silver-blue), var. *brevifolia* (smaller than species), ‘Pendula’, ‘Sargentii’ (5' dwarf), var. *stenocoma* (more cold hardy; stiff)

L	M	M	M	M	M	4-8		*Chamaecyparis obtusa* — Hinoki falsecypress	L	M	H	❊	P			✔	✔	‘Crippsii’ (broad, yellow-green), ‘Filicoides’ (shrubby; pendulous twigs), ‘Gracilis’ (dark green, narrow pyramid), ‘Nana’ (small shrub)
L	H	H	M	L	M	7-9		*Cupressus arizonica* — Arizona cypress	M	M	H		P		✔		✔	✔	‘Gareei’ (silver-blue), ‘Pyramidalis’ (narrow, conical; blue foliage)
L	H	H	M	L	M	7-9		*Cupressus sempervirens* — Italian cypress	M	H	H		P		✔		✔	✔	‘Glauca’ (blue-green; columnar), ‘Roylei’ (bright green; stiff-upright), ‘Stricta’ (narrow, columnar; green), ‘Swane’s Gold’ (yellow-green; narrow)
L	H	H	H	L	H	3-9		*Juniperus chinensis* — Chinese juniper	M	M	M	✔	P		✔			✔	Numerous, all forms, sizes, and colors; includes ‘Hetzii’ (15' tall) and ‘Pfitzeriana’ (wide shrub)
L	H	H	H	L	H	4-7		❖*Juniperus osteosperma* — Utah juniper	M	M	H	✔	R		✔			✔	None available
L	H	H	H	L	H	3-7		❖*Juniperus scopulorum* — Rocky Mountain juniper	M	M	H	❊	P		✔			✔	Numerous; many are blue; ‘Pathfinder’ (narrow pyramidal), ‘Wichita Blue’ (tall pyramidal)
L	H	H	H	L	H	2-9		*Juniperus virginiana* — eastern redcedar	M	M	H	❊	P		✔				Numerous; ‘Glauca’, ‘Globosa’, ‘Manhattan Blue’ (compact pyramidal), ‘Pendula’
M	L	M	H	L	H	2-6	6,8	*Larix decidua* — European larch	H	H	H		P		✔	✔		✔	‘Fastigiata’ (very narrow), ‘Pendula’
M	L	M	H	L	H	4-7	6,8	*Larix kaempferi* — Japanese larch	H	H	H		P		✔	✔		✔	‘Blue Rabbit’ (narrow pyramidal with blue-green foliage), ‘Dervaes’ (horizontal branches, drooping branchlets), ‘Pendula’

Cultural Characteristics: Tolerant of									Tree Selection Guide	General Species Characteristics									Available Cultivars
Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments			Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Orn. Features: Flowers	Fruit	Fall Color	Bark	Foliage	
L	M	L	L	M	M	4-8	8		*Metasequoia glyptostroboides* — dawn redwood	H	H	H		P			✔	✔	✔	‘National’ (narrow pyramidal), ‘Sheridan Spire’ (upright)
M	M	M	L	M	M	2-7			*Picea abies* — Norway spruce	M	H	H	❊	P		✔			✔	Numerous; ‘Nidiformis’ (called “bird’s nest spruce”; tight, spreading, shrubby), ‘Pendula’ (name for cultivars with weeping branchlets)
L	M	M	M	H	M	2-5			❖*Picea engelmannii* — Engelmann spruce	L	H	H		P					✔	None available
L	M	M	M	H	M	2-6			*Picea glauca* — white or Blackhills spruce	L	H	H	❊	P		✔			✔	‘Conica’ or ‘Dwarf Alberta’ (very small, tight; tiny needles; common in Utah), ‘Densata’ (also called “Blackhills spruce”; tall, narrow; nice form)
L	M	M	M	H	M	4-7			*Picea omorika* — Serbian spruce	L	H	H	❊	P					✔	‘Expansa’ (wide shrub), ‘Nana’ (round or conical; 10' high), ‘Pendula’ (tall, narrow; branches droop)
L	M	M	M	M	M	2-7			❖*Picea pungens* — blue or Colorado blue spruce	M	H	H	❊	P					✔	Numerous; ‘Argentea’ (silver-white needles), ‘Glauca Globosa’, ‘Glauca Pendula’, ‘Hoopsii’ (dense pyramidal), ‘Mission Blue’ (very blue)

L	H	M	M	L	M	5-7	❖*Pinus aristata (longaeva)* — bristlecone pine	L	M	H		I	✔		✔	None available
L	M	M	M	L	M	4-8	*Pinus bungeana* — lacebark pine	L	H	H		P		✔		None available
L	H	M	M	L	M	2-6	❖*Pinus contorta* — lodgepole pine	M	H	H		P				None available; plant local sources
L	M	M	M	L	M	3-7	*Pinus densiflora* — Japanese red pine	M	H	H	✲	I		✔		‘Globosa’ (round shrub to 10'-15'), ‘Oculis-draconis’ (yellow banded leaves), ‘Pendula’, ‘Umbraculifera’
L	H	H	M	L	M	4-8	❖*Pinus edulis* — pinyon, Colorado pinyon	L	M	H	✔	R	✔		✔	None available
L	H	M	M	L	M	4-7	❖*Pinus flexilis* — limber pine	L	M	H	✲	P			✔	‘Columnaris’, ‘Glauca Pendula’, ‘Nana’, ‘Pendula’, ‘Vandewolf’s Pyramid’ (upright; fast growth; blue)
M	H	H	H	L	M	8-10	*Pinus halepensis* — Aleppo pine	M	M	H		P			✔	None available
L	H	H	M	L	M	5-9	❖*Pinus monophylla* — singleleaf pinyon	L	M	H	✔	R	✔		✔	None available
L	M	M	L	M	M	5-8	*Pinus monticola* — western white pine	M	H	H		P	✔		✔	None available
M	H	H	M	L	H	2-8	*Pinus mugo* — Mugo pine	M	L	M	✔	S				‘Compacta’ (dense, round, 4' tall), ‘Gnom’ (15" tall by 3' wide), ‘Mops’ (3' tall by 3' wide), var. *mugo* (8' tall), var. *pumilio* (prostrate, 10' wide)
L	H	H	H	L	M	4-7	*Pinus nigra* — Austrian pine	M	H	H	✲	P				‘Hornibrookiana’ (very compact dwarf, 6' wide and 2' high), ‘Pyramidalis’

Cultural Characteristics: Tolerant of								Tree Selection Guide	General Species Characteristics									Available Cultivars
Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments		Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Orn. Features: Flowers	Orn. Features: Fruit	Orn. Features: Fall Color	Orn. Features: Bark	Orn. Features: Foliage	
L	M	M	H	L	M	4-7		*Pinus parviflora* — Japanese white pine	L	H	H	❊	P					✔	‘Bergman’ (wide, rounded shrub), ‘Brevifolia’ (narrow crown; short needles), ‘Glauca’
L	H	M	M	L	M	3-7		❖*Pinus ponderosa* — ponderosa pine	M	H	H		P				✔		None available
L	M	M	M	L	M	5-9		*Pinus strobiformis* — southwestern white pine	M	M	M		P					✔	None available; plant cold-hardy sources
L	M	M	L	M	M	3-8		*Pinus strobus* — eastern white pine	M	H	M	❊	P					✔	‘Compacta’, ‘Contorta’ (irregular crown; twisted branches), ‘Fastigiata’, var. *glauca*, ‘Pendula’ (weeping crown)
L	H	M	L	L	M	2-8		*Pinus sylvestris* — Scotch or Scots pine	M	H	H		P				✔	✔	‘Argentea’ (silvery leaves), ‘Aurea’, ‘Fastigiata’, ‘French Blue’ (leaves blue-green in winter)
L	H	M	H	L	M	5-9		*Pinus thunbergii* — Japanese black pine	M	M	H	❊	I					✔	‘Compacta’, ‘Globosa’, ‘Iseli’ (gold variegated; small), ‘Majestic Beauty’ (large tree; dark green)
L	M	M	M	L	M	5-7		*Pinus wallichiana* — Himalayan or Bhutan pine	M	H	H		P		✔			✔	‘Oculis-draconis’ (leaves with cream-colored bands)

M	L	H	M	L	M	4-6		❖*Pseudotsuga menziesii* — Douglas-fir	M	H	H	✻	P	✔				‘Fastigiata’, ‘Fletcheri’ (6' dwarf), var. *glauca* (blue-green needles), ‘Pendula’
M	L	M	L	M	M	6-8		*Sequoiadendron giganteum* — giant sequoia	M	H	H		P	✔		✔	✔	‘Pendulum’ (main stem curves and twists)
H	M	M	H	L	M	4-9	6,8	*Taxodium distichum* — baldcypress	M	H	H		P	✔	✔	✔	✔	‘Monarch of Illinois’ (wide, large crown), ‘Pendens’ (pyramidal; branchlets droop), ‘Shawnee Brave’ (narrow crown)
H	M	H	M	L	M	2-8	6	*Thuja occidentalis* — northern white-cedar, eastern arborvitae	M	M	M	✻	P	✔			✔	Numerous; cold hardy include ‘Emerald’ and ‘Nigra’ (narrow pyramidal), ‘Techny’ (broad pyramidal)
H	M	H	L	L	M	6-9	6	*Thuja (Platycladus) orientalis* — Oriental arborvitae	L	M	M	✻	P	✔			✔	Numerous; ‘Aurea Nana’ (5'; round), ‘Baker’ (bright green; likes heat), ‘Compacta’ (small, pyramidal)
H	M	H	L	H	H	5-7	6	*Thuja plicata* — western redcedar	M	H	H		P	✔			✔	‘Canadian Gold’ (gold leaves), ‘Fastigiata’, ‘Zebrina’ (yellow variegated foliage; gets 60' tall)
Broadleaves (mostly deciduous)																			
M	H	M	M	L	H	5-9		*Acer buergeranum* — trident maple	L	M	M	✔	R		✔	✔	✔	Dwarf and variegated cultivars available
M	M	H	H	M	H	4-8		*Acer campestre* — hedge maple	M	M	M	✻	B		✔			‘Compactum’ (shrubby), ‘Fastigiatum’, ‘Queen Elizabeth’ (small to medium size)
M	H	M	M	M	H	2-8		*Acer ginnala* — Amur or Ginnala maple	M	L	M	✔	R		✔			‘Compactum’ (shrubby), ‘Flame’ (shrub to small tree; red fruits; deep red fall color)
M	M	M	M	M	H	2-8		❖*Acer glabrum* — Rocky Mountain maple	M	L	M	✔	R		✔			None available

Cultural Characteristics									Tree Selection Guide	General Species Characteristics										Available Cultivars
Tolerant of															Orn. Features					
Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments		Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Flowers	Fruit	Fall Color	Bark	Foliage	
M	M	H	M	M	M	4-7		❖*Acer grandidentatum* — canyon or bigtooth maple	M	M	H		O			✔			‘Autumn Glow’ (upright tree form; good fall color)
M	L	M	M	M	L	4-8		*Acer griseum* — paperbark maple	L	M	M	✔	O			✔	✔		Some hybrids available
H	H	H	M	M	H	2-9	2	❖†*Acer negundo* — boxelder, ash-leaved or Manitoba maple	H	H	M		O						‘Baron’ (seedless), ‘Sensation’ (red fall color), several with variegated foliage
L	H	H	M	M	M	4-8		*Acer nigrum* — black maple	M	H	H		O			✔			‘Greencolumn’ (upright, columnar; often called *A. saccharum*)
L	L	M	M	H	M	5-8		*Acer palmatum* — Japanese maple	L	L	M	✔	R			✔	✔	✔	Numerous; var. *atropurpureum* and ‘Bloodgood’ (reddish-purple leaves), ‘Crimson Queen’ (red, deeply lobed leaves), ‘Viridis’ (green leaves)
M	M	H	H	M	H	3-8		*Acer platanoides* — Norway maple	M	H	H		R			✔		✔	Numerous; ‘Columnare’, ‘Erectum’ (narrow), ‘Crimson King’ (maroon), ‘Emerald Queen’ (dark green), ‘Schwedleri’ (starts purple, turns green)
M	H	H	H	M	M	4-7		*Acer pseudoplatanus* — sycamore maple	M	H	H		O		✔			✔	‘Atropurpureum’ (leaves purple underneath), ‘Brilliantissimum’ (leaves start pink to cream)

H	L	M	L	M	M	3-9		*Acer rubrum* — red maple	M	H	H		O			✔		Numerous; ‘Autumn Blaze’ (orange-red fall color), ‘Autumn Flame’ (red fall color, small leaves), ‘Columnare’, ‘Red Sunset’ (pyramidal)
H	H	M	H	M	H	3-9		†*Acer saccharinum* — silver maple	H	H	H		O			✔		‘Blair’ (strong branching), ‘Laciniatum’, ‘Silver Queen’ (leaves silver beneath), ‘Wieri’ (drooping branches)
L	M	H	L	H	M	4-8		*Acer saccharum* — sugar maple	M	H	H		O			✔		Numerous; ‘Bonfire’ (good red fall color), ‘Globosum’, ‘Green Mountain’ (heat tolerant)
M	H	H	M	M	M	3-8		*Acer tataricum* — Tatarian maple	M	M	H	✔	R			✔		‘Rubrum’ (deep red fall color)
M	M	M	M	M	M	4-8		*Acer truncatum* — purpleblow or Shantung maple	L	M	M	✔	R			✔	✔	Norway maple hybrids ‘Norwegian Sunset’ (upright-oval; heat tolerant), ‘Pacific Sunset’ (upright-spreading; red in fall)
M	M	M	M	M	M	7-8	3	*Aesculus californica* — California buckeye	M	M	H		R	✔	✔	✔	✔	None available
M	M	M	M	M	M	3-8	3	*Aesculus* x *carnea* — red horsechestnut	M	M	M		R	✔				‘Briotii’ (flowers deeper red in 10" groups), ‘O’Neill’ (better red flowers in 10"-12" groups)
M	M	M	M	M	M	3-7	3	*Aesculus glabra* — Ohio buckeye	M	M	H	✻	R	✔	✔	✔	✔	var. *nana* (dwarf, shrubby)
M	M	M	H	M	M	3-8	3	*Aesculus hippocastanum* — horsechestnut	M	H	H		R	✔				‘Baumannii’ (double white flowers; no fruit)
H	H	H	H	M	H	4-8	2,3,5	†*Ailanthus altissima* — tree-of-heaven, ailanthus	H	H	M		V				✔	‘Erythrocarpa’ (red fruit), ‘Metro’ (male, no fruit; tight crown), ‘Pendulifolia’ (long leaves hang down)

Cultural Characteristics								Tree Selection Guide	General Species Characteristics									Available Cultivars
Tolerant of														Orn. Features				
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L	H	M	M	L	H	6-9	1,3	*Albizia julibrissin* — mimosa, silk-tree, albizia	H	M	M		B	✔				✔	‘E.H. Wilson’ and ‘Rosea’ (hardy to -15°F)
H	M	M	L	M	H	3-7	6	*Alnus glutinosa* — European or common alder	H	M	M		O		✔				‘Aurea’, ‘Laciniata’, ‘Fastigiata’ (narrow like Lombardy poplar)
H	M	H	L	M	H	1-7	6	❖*Alnus tenuifolia* — thinleaf or mountain alder	M	M	M		O		✔				None available
L	H	H	M	M	M	2-7		❖*Amelanchier alnifolia* — Saskatoon, western serviceberry	L	L	M	✔	S	✔		✔			‘Regent’ (compact, shrubby), ‘Success’ (heavy fruit)
L	M	M	M	H	M	4-9		*Amelanchier arborea* — downy serviceberry	L	L	M	✔	I	✔		✔			‘Autumn Sunset’ (good orange fall color), ‘Springtime’ (good flowers and fall color; 12' tall)
L	H	H	M	M	M	4-8		❖*Amelanchier utahensis* — Utah serviceberry	L	L	M	✔	S	✔		✔			None available
H	L	L	M	M	M	4-9	6	*Betula nigra* — river birch	H	H	M		O				✔		‘Heritage’ (attractive bark; superior selection)
H	L	M	M	H	M	3-7	6	❖*Betula occidentalis* — water or river birch	L	L	M	✔	S			✔	✔		None available
L	L	M	H	M	M	2-7	1,6	*Betula papyrifera* — paper birch	M	M	L		P			✔	✔		None available

L	L	M	M	M	H	2-7	1,6	*Betula pendula* — European white birch	M	H	M		P			✔	✔		‘Dalecarlica’ (cut leaves; weeping form), ‘Fastigiata’, ‘Purpurea’
M	M	M	L	M	M	4-8		*Carpinus betulus* — European hornbeam	L	M	M		R		✔		✔		‘Asplenifolia’ (deeply toothed leaves), ‘Columnaris’, ‘Fastigiata’ (20'-30' wide), ‘Globosa’, ‘Pendula’, ‘Purpurea’, ‘Variegata’
M	M	M	L	H	M	3-9		*Carpinus caroliniana* — American hornbeam, musclewood	L	M	M		R		✔	✔	✔		‘Pyramidalis’ (similar to species)
M	M	M	M	L	M	4-9	3	*Castanea mollissima* — Chinese chestnut	M	L	M		R	✔	✔			✔	Some hybrids available
M	M	H	M	M	H	5-9	2,3	*Catalpa bignonioides* — southern catalpa	M	M	M	❊	R	✔	✔				‘Aurea’, ‘Nana’ (see below)
M	M	H	M	M	H	5-9	2	*Catalpa bignonioides* ‘Nana’ — umbrella catalpa	L	L	M	✔	R						‘Nana’ (sterile, grafted dwarf)
M	H	H	M	M	H	4-9	2,3	†*Catalpa speciosa* — northern or western catalpa	H	H	M		O	✔	✔				None available
M	H	H	M	M	H	2-9		*Celtis occidentalis* — hackberry, common hackberry	H	H	H		V			✔	✔		‘Chicagoland’ (single leader), ‘Prairie Pride’ (very good form), ‘Windy City’ (good form)
M	H	H	M	M	H	5-9		❖*Celtis reticulata* — netleaf hackberry	M	M	H		V			✔	✔		None available
M	L	M	M	M	L	4-8	6	*Cercidiphyllum japonicum* — katsuratree	M	L	M		O			✔		✔	‘Pendula’ (graceful, weeping, blue-green mound)

Cultural Characteristics								Tree Selection Guide	General Species Characteristics										Available Cultivars
Tolerant of															Orn. Features				
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L	H	H	L	H	M	3-9		*Cercis canadensis* — eastern redbud, Judas-tree	M	L	H	✔	B	✔			✔	✔	var. *alba* (white flowers), ‘Forest Pansy’ (purple leaves), ‘Silver Cloud’ (white variegated leaves)
L	H	H	L	H	M	7-9		❖*Cercis occidentalis* — California or western redbud	M	L	H	✔	B	✔			✔	✔	None known
M	H	H	M	L	M	3-8	7	❖*Cercocarpus ledifolius* — curlleaf mountain-mahogany	M	L	H	✔	I		✔			✔	None available
M	M	H	M	L	M	8-10	3	❖*Chilopsis linearis* — desertwillow	M	M	L		I	✔	✔				None available
H	M	M	M	H	M	3-9		*Chionanthus virginicus* — fringetree, white fringetree	L	M	M		S	✔					‘Floyd’ (upright habit; mostly male, little fruit)
M	M	H	M	M	M	4-8		*Cladrastis lutea* — yellowwood	M	H	M		R	✔			✔	✔	‘Rosea’ (pink flowers)
L	L	M	M	M	L	3-7		*Cornus alternifolia* — pagoda or alternate-leaf dogwood	M	L	M	✔	L	✔	✔				‘Argentea’ (leaves with white variegations; shrubby)
L	L	M	M	H	L	5-9		*Cornus florida* — flowering dogwood	L	L	M	✔	L	✔	✔	✔	✔		Numerous; ‘Cherokee Chief’ (red flowers), ‘Cloud 9’ (cold-hardy), var. *rubra* (pink-red flowers), ‘World’s Fair’ (cold hardy; drought resistant)

L	L	M	M	M	M	3-7		*Cornus kousa* — Kousa dogwood	L	L	M	✔	L	✔	✔	✔	✔		Numerous; var. *chinensis* (larger flowers and tree size), ‘Dwarf Pink’ (small tree; pink flowers), ‘Fanfare’ (upright form; very cold-hardy)
M	M	H	L	M	M	4-8		*Cornus mas* — corneliancherry dogwood	L	L	M	✔	R	✔	✔		✔		‘Alba’ (white fruit), ‘Flava’ (yellow fruit), ‘Golden Glory’ (heavy flowering), ‘Nana’, ‘Variegata’
H	M	H	L	M	H	2-8		❖*Cornus sericea* — red-osier or red-stemmed dogwood	M	L	M	✔	S	✔	✔		✔		‘Cardinal’ (bright red stems), ‘Flaviramea’ (yellow stems), ‘Isanti’ (bright red stems; compact), ‘Kelseyi’ (compact)
M	M	H	L	M	M	4-9		*Corylus americana* — American hazelnut	M	L	M	✔	S	✔	✔		✔	✔	None known
M	M	H	L	L	M	4-7		*Corylus colurna* — Turkish filbert, Turkish hazel	M	M	H		P				✔	✔	None available
M	M	H	L	L	M	4-8		*Corylus cornuta* — beaked hazelnut	M	L	M	✔	S	✔	✔		✔	✔	None available
L	H	H	M	M	H	4-9		*Cotinus coggyria* — common smoketree, smokebush	M	L	M	✔	S	✔		✔		✔	‘Flame’ (good orange-red fall color), ‘Royal Purple’ (dark purple mature leaves), ‘Pendulus’
L	H	H	M	M	H	3-8		*Cotinus obovatus* — American smoketree, chittamwood	M	M	M		O	✔		✔	✔		‘Grace’ (red leaves; pink flowers), ‘Red Leaf’
L	H	H	M	L	M	5-9	7	❖*Cowania mexicana* — cliffrose, quininebush	L	L	M	✔	S	✔	✔				None available
M	H	H	M	L	M	3-8	4	*Crataegus crusgalli* — cockspur hawthorn	M	L	M	✔	B	✔	✔	✔		✔	var. *inermis* (thornless), ‘Hooks’ (fewer thorns)

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Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments		Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Flowers	Fruit	Fall Color	Bark	Foliage	
M	H	H	M	L	M	4-8	4	*Crataegus* x *lavallei* — Lavalle hawthorn	M	L	M	✔	I	✔	✔	✔			Hybrid of *C. stipulacea* and *C. crusgalli*
M	M	M	M	L	M	4-8	4	*Crataegus laevigata* — English hawthorn	M	L	M	✔	R	✔	✔				‘Crimson Cloud’ (blight resistant), ‘Paul’s Scarlet’ (red, doubled flowers; very showy)
M	H	H	M	L	M	3-8	4	*Crataegus phaenopyrum* — Washington hawthorn	M	L	M	✔	B	✔	✔	✔			‘Clark’ (heavy fruiting), ‘Fastigiata’, ‘Vaughn’ (hybrid with *C. crusgalli*; heavy fruiting)
M	H	H	M	L	M	4-8	4	*Crataegus viridis* — green hawthorn	M	L	M	✔	B	✔	✔	✔			‘Winter King’ (vase-shaped; red fruit attractive in winter; excellent tree)
L	H	H	H	L	M	2-7		†*Elaeagnus angustifolia* — Russian-olive	H	M	M		R		✔			✔	‘Red King’ (rust red fruits)
M	H	H	M	M	H	8-10	3,7	*Eriobotrya japonica* — loquat	M	L	M	✔	I	✔	✔			✔	‘Golden Nugget’ (large; abundant fruit), ‘Variegata’ (white variegations)
L	L	M	L	H	M	3-9		*Fagus grandifolia* — American beech	L	M	H		O			✔	✔	✔	None available
L	L	M	L	H	M	4-7		*Fagus sylvatica* — European beech	L	M	H		O			✔	✔	✔	‘Asplenifolia’ (cut leaves), ‘Pendula’, ‘Purpurea Tricolor’ (purple variegated leaves)

M	M	H	H	M	M	3-9		*Fraxinus americana* — white ash	M	H	H		O		✔			‘Autumn Applause’ (tight, oval crown), ‘Autumn Purple’ (seedless), ‘Rosehill’ (seedless)
M	H	H	H	L	M	6-9		❖*Fraxinus anomala* — singleleaf or dwarf ash	L	L	M	✔	I					None available
M	M	H	H	M	M	3-9	1	†*Fraxinus excelsior* — European ash	M	H	H		R					‘Aurea’, ‘Globosa’ (30' tall), ‘Pendula’, ‘Rancho’ (30' tall; yellow fall color)
H	H	H	H	M	H	3-9	1	*Fraxinus pennsylvanica* — green ash	H	H	H		O		✔			‘Marshall’s Seedless’, ‘Patmore’ (seedless), ‘Summit’ (upright, pyramidal)
M	M	H	M	M	M	4-7		*Fraxinus quadrangulata* — blue ash	M	H	H		R				✔	‘True Blue’ (very good for high pH soils, leaves stay dark green)
M	H	M	M	M	M	7-9		❖*Fraxinus velutina* — velvet or Modesto ash	M	M	M		R					‘Modesto’ (glabrous leaves)
M	H	H	M	L	M	3-9	3	*Ginkgo biloba* — ginkgo, maidenhair tree	M	H	H		O		✔		✔	All males; ‘Autumn Gold’ (good fall color), ‘Fastigiata’, ‘Pendula’, ‘Santa Cruz’ (spreading)
H	H	H	H	L	H	3-9	3,4	*Gleditsia triacanthos* — honeylocust	H	H	M		R		✔		✔	All thornless; ‘Imperial’ (few pods), ‘Moraine’ (fruitless; very good tree), ‘Shademaster’ (dark green; few pods), ‘Skyline’ (good fall color)
M	H	H	M	M	M	3-8	3	*Gymnocladus dioicus* — Kentucky coffeetree	M	H	H		R	✔	✔	✔	✔	‘Variegata’ (white variegations on green leaves)
M	M	M	M	M	L	5-9	7	*Ilex opaca* — American holly	L	M	M		I	✔			✔	‘Amy’ (large leaves; abundant fruit), ‘Goldie’ (yellow fruit), ‘Wyetta’ (pyramidal)
M	M	H	M	L	L	3-7		*Juglans cinerea* — butternut	M	H	M		R					None available

Cultural Characteristics: Tolerant of								Tree Selection Guide	General Species Characteristics										Available Cultivars
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M	H	H	M	L	L	7-9		*Juglans major* — Arizona walnut	L	M	H		O					✔	None available
M	M	H	M	L	L	4-9	3	*Juglans nigra* — black walnut	M	H	H		O			✔		✔	‘Laciniata’ (dissected leaflets)
M	M	H	M	L	L	4-8	3	*Juglans regia* — English or Persian walnut	M	H	H		R					✔	‘Carpathian’ (very cold hardy), ‘Hansen’ (good fruit production), ‘Laciniata’, ‘Pendula’
M	H	H	H	L	M	5-9	2	*Koelreuteria paniculata* — goldenraintree	M	M	M		O	✔	✔				‘Fastigiata’, ‘September’ (flowers late summer; not as cold-hardy as others)
M	M	H	M	M	L	5-7	2	*Laburnum* x *watereri* — goldenchain tree, Waterer laburnum	M	L	M	✔	O	✔					‘Alford’s Weeping’, ‘Aureum’ (golden-yellow leaves), ‘Pendulum’, ‘Vossii’ (dense crown; 2' long inflorescences)
L	M	H	H	M	H	7-9	5	*Lagerstroemia indica* — crapemyrtle	M	L	M	✔	S	✔		✔	✔		Numerous; ‘Acoma’ (white flowers; semi-dwarf), ‘Hopi’ (pink flowers; semi-dwarf), ‘Yuma’ (lavender flowers; taller, upright)
H	M	L	M	L	M	5-9	3	*Liquidambar styraciflua* — sweetgum, American sweetgum	H	H	H		P		✔	✔		✔	‘Burgundy’ (deep red fall color), ‘Festival’ (narrower crown; yellow to pink fall color), ‘Rotundiloba’ (fruitless; rounded leaf lobes)

M	M	M	L	M	M	4-9		*Liriodendron tulipifera* — yellow-poplar, tuliptree, tulip-poplar	H	H	H		O	✔	✔	✔		✔	'Compactum' (medium size), 'Fastigiatum' (20' wide), 'Tortuosum' (curled leaves and stems)
M	H	H	M	L	H	4-9	3,4	*Maclura pomifera* — Osage-orange	M	M	H		R			✔	✔		var. *inermis* (thornless)
L	L	M	M	M	L	3-8		*Magnolia acuminata* — cucumbertree, cucumber magnolia	M	H	H		O	✔	✔				'Golden Glow' and 'Yellow Bird' (good yellow flowers); 'Variegata' (yellow leaf blotches)
M	M	M	M	M	L	6-9	7	*Magnolia grandiflora* — southern magnolia	M	H	H		P	✔	✔			✔	Numerous; 'Bracken's Brown Beauty' (good, dense crown), 'Majestic Beauty' (large leaves)
L	L	M	M	M	L	3-8		*Magnolia kobus* — Kobus magnolia	L	M	H		O	✔					var. *borealis* (large, pyramidal crown), 'Wada's Memory' (hybrid; large flowers; fast growing)
L	L	M	M	M	L	3-8		*Magnolia* x *loebneri* — Loebner magnolia	L	M	M		O	✔					'Ballerina' (many petals; fragrant), 'Merrill' (medium height; heavy flowering), 'Spring Snow' (superior cultivar; medium height)
L	L	M	M	M	L	4-9		*Magnolia* x *soulangiana* — saucer magnolia	M	M	H	❊	R	✔			✔		'Brozzonii' (large white flowers open late), 'Lennei' (dark purple-pink petals; shrubby), 'San Jose' (large, pink-purple flowers; fast grower)
L	L	M	M	M	L	4-9		*Magnolia stellata* — star magnolia	L	L	M	✔	R	✔					'Centennial' (doubled flowers, pinkish), 'Dawn' (pink stripe on petal), 'Royal Star' (superior)
M	M	H	M	L	H	3-9	3,5	*Malus pumila* — apple	M	M	M		V	✔	✔				Many choices available

Cultural Characteristics								Tree Selection Guide	General Species Characteristics										Available Cultivars
Tolerant of															Orn. Features				
Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments		Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Flowers	Fruit	Fall Color	Bark	Foliage	
M	M	H	H	L	H	3-9	3,5	*Malus* spp. — crabapple	M	L	M	✔	R	✔	✔			✔	Numerous cultivars available
M	H	H	H	M	H	8-10	1,2, 3,5	†*Melia azedarach*— Chinaberry	H	M	M		R	✔	✔				‘Umbraculiformis’ (domed shape; multi-stemmed; called “Texas Umbrellatree”)
H	H	H	H	L	H	4-9	3	*Morus alba* — white mulberry	H	H	M		R					✔	‘Hampton’ (fruitless; wide crown), ‘Mapleleaf’ (large, maple-like leaves; fruit-less), ‘Pendula’ (weeping, twisted; fruiting), ‘Pyramidalis’
H	H	H	H	L	H	5-9	3	*Morus rubra* — red mulberry	H	H	M		R					✔	None available
L	H	H	M	H	M	6-9		❖*Ostrya knowltonii* — Knowlton hophornbeam	L	M	H		I	✔	✔			✔	None available
L	M	H	M	H	M	3-9		*Ostrya virginiana* — eastern hophornbeam, ironwood	L	M	H		I	✔	✔			✔	None available
M	H	H	M	L	M	3-8		*Phellodendron amurense* — Amur corktree	M	M	H		R		✔	✔	✔		‘Macho’ (fruitless; good branching habit), ‘Shademaster’ (fruitless)
M	H	H	H	L	H	6-9		*Pistacia chinensis* — Chinese pistache	M	M	H		R			✔			‘Keith Davey’ (male; no fruit)
M	H	H	H	L	H	4-9		*Pistacia vera* — pistachio	L	L	H	✔	R		✔	✔		✔	Unknown
M	H	M	M	M	H	4-9	3	*Platanus* x *acerifolia* — London planetree	H	H	H		R		✔		✔		‘Bloodgood’, ‘Columbia’, and ‘Liberty’ (all anthracnose resistant)

H	H	H	M	M	H	4-9	3	*Platanus occidentalis* — American sycamore or planetree	H	H	H	O	✔		✔		‘Howard’ (uncommon; new foliage yellow)
M	M	H	H	L	H	3-9	2,5,6	*Populus alba* — white poplar	H	H	H	O			✔	✔	‘Pyramidalis’, ‘Richardii’ (upper leaf surfaces white)
H	M	H	H	L	H	3-9	2,6	❖*Populus angustifolia* — narrowleaf cottonwood	H	H	H	O		✔			None available; naturally forms hybrids, such as lanceleaf cottonwood, *P.* X *acuminata*
M	M	H	H	L	H	2-5	2,6	❖*Populus balsamifera* — balsam poplar	H	H	M	O					Some hybrids
M	M	H	H	L	H	3-9	2,6	†*Populus* X *canadensis* — Carolina poplar	H	H	M	O					‘Eugenei’ (columnar), ‘Noreaster’ (some canker resistance), ‘Robusta’ (small oval)
H	M	M	M	L	H	2-8	1,2,6	†*Populus candicans* — balm-of-Gilead	H	H	M	O					‘Aurora’ (leaves variegated when young)
H	M	H	H	L	H	2-9	2,6	*Populus deltoides* — eastern cottonwood	H	H	H	O		✔			‘Platte’, ‘Noreaster’ (both canker resistant), ‘Siouxland’ (canker susceptible), many hybrids
H	M	H	H	L	H	5-9	2,6	❖*Populus fremontii* — Fremont cottonwood	H	H	H	O		✔			None available
M	M	H	H	L	H	3-9	1,6	†*Populus nigra* ‘Italica’ — Lombardy poplar	H	H	L	C		✔			‘Italica’ (typical narrow crown), ‘Theves’ (wider)
M	M	M	M	L	H	3-7	1,5	❖†*Populus tremuloides* — quaking or trembling aspen	M	H	M	O		✔	✔	✔	None available
H	M	H	H	L	H	3-8	2,6	❖*Populus trichocarpa* — black cottonwood	H	H	H	O		✔			None available

Cultural Characteristics								Tree Selection Guide	General Species Characteristics									Available Cultivars
Tolerant of														Orn. Features				
Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments		Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Flowers	Fruit	Fall Color	Bark	Foliage	
L	H	H	H	L	M	7-10	3,4	❖*Prosopis juliflora* — honey mesquite	L	M	H		B	✔	✔				None available
L	M	M	H	L	M	4-9	3,5	*Prunus armeniaca* — apricot	M	M	M		V	✔	✔				‘Manchurian’ (20' tall; round crown; pink flowers), many others available
L	M	M	M	L	M	3-8	3	*Prunus avium* — sweet cherry, mazzard	M	M	M		V	✔					‘Plena’ (double white flowers)
L	M	M	M	L	M	5-8	2,3	*Prunus cerasifera* — purpleleaf, cherry, or Myrobalan plum	M	L	L	✔	R	✔			✔	✔	‘Newport’ (dark purple leaves; more cold hardy), ‘Thundercloud’ (less cold hardy; pink flowers)
L	M	M	M	M	M	3-9	3	*Prunus cerasus* — sour cherry	M	M	M		V	✔					var. *umbraculifera* (compact; round habit), var. *persiciflora* (pink flowers), many others
L	M	M	M	L	M	4-9	3	*Prunus domestica* — common plum	M	L	L	✔	R	✔			✔		Numerous
L	M	M	M	M	M	3-6	1,3	*Prunus padus* — European birdcherry, May Day tree	M	M	M		I	✔					‘Abertii’ (30' pyramidal), var. *commutata* (1/2" flowers), ‘Summer Glow’ (purple leaves)

L	M	M	M	L	M	5-9	1,3	*Prunus persica* — peach	M	M	M		R	✔			✔	✔	Numerous; ‘Alba Plena’ (double white flowers), ‘Early Double Red, Pink, or White’ (early blooming), ‘Royal Red Leaf’ (red-purple leaves)
L	M	M	M	L	M	4-7	3	*Prunus sargentii* — Sargent cherry	M	M	M		V	✔			✔	✔	‘Columnaris’, ‘Rancho’ (very narrow crown), also many hybrids
L	M	M	M	L	M	5-9		*Prunus serrulata* — Japanese flowering or Oriental cherry	M	M	M	✔	V	✔			✔		‘Amanogawa’ (narrow upright form), ‘Kwanzan’ (double flowers; often grafted at 4'-6')
L	M	M	M	L	M	4-9		*Prunus subhirtella* — Higan cherry	M	M	M		B	✔			✔		var. *pendula*, var. *autumnalis* (double flowers), ‘Yae-shidare-higan’ (weeping; double flowers)
L	M	M	M	L	M	2-9	3	❖*Prunus virginiana* — common chokecherry	M	M	L	✔	S	✔				✔	‘Schubert’ or ‘Canada Red’ (pyramidal form; red-green foliage)
L	M	M	M	L	M	5-8		*Prunus* x *yedoensis* — Yoshino cherry	M	M	M		V	✔					‘Afterglow’ (pink flowers; 25'x25'), ‘Ivensii’ (white flowers; weeping)
L	M	M	M	H	H	3-9		❖*Ptelea angustifolia* — common or western hoptree, wafer-ash	L	L	M	✔	S		✔	✔	✔		None available
M	H	H	M	L	H	5-9	2	*Pyrus calleryana* — Callery pear	M	M	M		P	✔		✔		✔	‘Aristocrat’ (better branch attachment), ‘Bradford’ (poor branch attachment), ‘Chanticleer’ (narrower crown, more cold hardy), ‘Redspire’ (pyramidal)
M	H	H	M	L	H	4-9	1,3	*Pyrus communis* — common pear	M	M	M		R	✔					Rarely planted as an ornamental
M	H	H	M	L	H	3-7	3	*Pyrus ussuriensis* — Ussurian pear	M	H	M		R	✔		✔		✔	‘Prairie Gem’ (good fall color; glossy leaves)

Cultural Characteristics								Tree Selection Guide	General Species Characteristics								Available Cultivars
Tolerant of														Orn. Features			
Poor Drainage	Drought	Alkalinity	Salt	Shade	Transplant Ease	Hardiness Zones	Comments		Growth Rate	Mature Height	Longevity	Power Lines OK	Crown Shape	Flowers	Fruit	Fall Color	Bark	Foliage	
M	H	L	M	M	M	5-9	3	*Quercus acutissima* — sawtooth oak	M	H	H		R			✔		✔	‘Gobbler’ (abundant acorns)
L	M	L	H	M	M	3-9	3	*Quercus alba* — white oak	M	H	H		R			✔		✔	None available
H	H	M	M	M	M	3-8	3	*Quercus bicolor* — swamp white oak	M	H	H		R					✔	None available
M	H	H	M	M	M	5-7	3	*Quercus cerris* — turkey oak	M	H	H		R	✔			✔		‘Argenteo-variegata’ (white blotches on leaf edges)
M	H	H	M	L	L	4-8	3,5	❖*Quercus gambelii* — Gambel, scrub, or Rocky Mountain white oak	L	L	M	✔	S			✔			None readily available
M	H	M	M	M	M	4-8	3	*Quercus imbricaria* — shingle or laurel oak	M	H	H		O			✔		✔	None available
M	H	H	M	M	M	2-8	3	*Quercus macrocarpa* — bur or mossycup oak	M	H	H		B	✔				✔	None available
M	H	H	M	M	M	4-7	3	*Quercus muehlenbergii* — chinkapin oak	M	H	H		O			✔		✔	None available
H	M	L	L	M	H	4-8	3	†*Quercus palustris* — pin oak	H	H	H		P			✔			‘Crownright’ (upright habit), ‘Sovereign’ (lower branches do not sweep down)

M	M	H	H	M	M	4-8	3	*Quercus robur* — English oak	M	H	H		R			✔	‘Atropurpurea’, ‘Fastigiata’ (upright, narrow), ‘Pendula’, ‘Westminster Globe’ (large, round)
L	M	M	H	M	M	4-8	3	*Quercus rubra* — northern red oak	M	H	H		O		✔	✔	‘Aurea’ (new leaves yellow, becoming green)
M	H	H	M	M	M	5-9	3	*Quercus shumardii* — Shumard oak	M	H	H		P		✔	✔	None available
M	H	H	M	M	M	7-9	3,7	❖*Quercus turbinella* — shrub live oak	L	L	M	✔	S			✔	None available
M	H	H	M	M	M	7-9	3,7	❖*Quercus undulata* wavyleaf oak	L	L	M	✔	S			✔	None available
M	H	H	H	L	H	3-8	4	*Robinia* X *ambigua* — Idaho flowering locust	M	M	M		O	✔		✔	‘Idaho’ (pink flowers; tough)
M	H	H	H	L	H	6-9	4	❖*Robinia neomexicana* — New Mexico locust	M	M	M		O	✔		✔	None available
M	H	H	H	L	H	3-9	1,4,5	*Robinia pseudoacacia* — black locust	M	M	M		O	✔	✔	✔	‘Purple Robe’ (medium height; dark pink flowers), ‘Pyramidalis’ (no spines on twigs)
H	L	H	H	L	H	2-8	2,6	❖*Salix amygdaloides* — peachleaf willow	H	M	M		O				None known
H	L	H	H	L	H	5-8	2,6	†*Salix babylonica* — weeping willow	H	H	M		W				‘Crispa’ (spiral leaves)
H	L	H	H	L	H	4-9	2,6	*Salix fragilis* — crack willow	H	H	M		O				Unknown
H	L	H	H	L	H	4-9	1,2,6	†*Salix matsudana* — Hankow willow (‘Globe Navajo’, etc.)	H	M	L		R				‘Golden Curls’ (hybrid; twisting, golden stems, ‘Navajo’ (round crown; troublesome), ‘Pendula’
H	L	H	H	L	H	4-9	2,6	*Salix nigra* — black willow	H	H	M		O				None known

Cultural Characteristics								Tree Selection Guide	General Species Characteristics										Available Cultivars
Tolerant of															Orn. Features				
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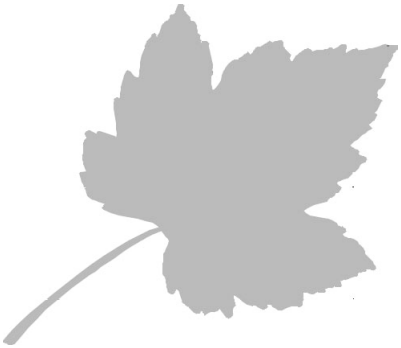
H	M	M	M	L	M	5-9	6	❖*Sambucus cerulea* — blue elder	M	M	L	✔	R	✔	✔		✔		None available
M	M	H	M	M	M	4-8	3	*Sophora japonica* — Japanese pagodatree, scholar-tree	M	M	H		R	✔					‘Columnaris’, ‘Fastigiata’, ‘Pendula’ (rarely flowers), ‘Regent’ (fast growth), ‘Variegata’
L	L	M	M	L	M	3-7		*Sorbus alnifolia* — Korean mountain-ash	M	M	M		O	✔	✔	✔			‘Redbird’ (persistent red fruit), some upright forms
L	L	M	M	L	M	2-7	1	*Sorbus americana* — American mountain-ash	M	M	L		O	✔	✔	✔			None available
L	L	M	M	L	M	3-7	1	†*Sorbus aucuparia* — European mountain-ash or rowan	M	M	L		O	✔	✔	✔			Numerous; ‘Asplenifolia’ (deeply divided leaves), ‘Cardinal Royal’ (fast growth, upright)
L	M	H	M	L	M	2-6	1	❖*Sorbus scopulina* — Greene mountain-ash	L	L	L	✔	S	✔	✔	✔			None available
M	M	H	H	L	M	3-7		*Syringa reticulata* — Japanese tree lilac	M	L	H	✔	O	✔			✔		‘Chantilly Lace’ (leaf edges yellow), ‘Ivory Silk’ (flowers young, heavy), ‘Regent’ (vigorous; upright), ‘Summer Snow’ (heavy flowering)
H	H	H	H	L	M	5-8		†*Tamarix ramosissima* — tamarisk, salt-cedar	M	L	M		S	✔					None available

M	M	H	L	M	H	2-9	5	*Tilia americana* — American basswood, American linden	M	H	H		O	✔	✔			‘Fastigiata’, ‘Lincoln’ (slender-upright), ‘Redmond’ (dense pyramidal crown)
M	M	H	L	M	H	3-7	2	*Tilia cordata* — littleleaf European linden	M	M	M		P	✔	✔			‘Chancellor’ (fastigiate when young, later pyramidal), ‘Greenspire’ (tough; common; upright), ‘Prestige’ (fast growing; strong form)
M	M	H	L	M	H	3-7	5	*Tilia* x *euchlora* — Crimean linden	M	H	H		O	✔	✔			‘Laurelhurst’ (broad, pyramidal crown)
M	M	H	M	M	H	4-7		*Tilia tomentosa* — silver linden	M	H	M		P	✔	✔			‘Fastigiata’ (‘Erecta’), ‘Green Mountain’ (rapid growing; tough), ‘Sterling’ (wide, pyramidal)
H	H	H	M	M	H	2-9	1	†*Ulmus americana* — American or white elm	H	H	L		V			✔		Some claimed to be disease resistant; not proven long-term — ‘Liberty’, ‘Washington’
M	H	H	M	M	M	4-9		*Ulmus parvifolia* — lacebark or Chinese elm	M	H	H		O				✔	✔	‘Emerald Isle’ (broad crown; good bark), ‘Emerald Vase’ (upright-spreading crown)
H	H	H	H	M	H	3-9	1,2	†*Ulmus pumila* — Siberian elm	H	H	M		O						‘Chinkota’ (very cold-hardy), ‘Pendula’
M	H	H	H	L	M	6-9	7	❖*Yucca brevifolia* — Joshua-tree	L	L	M	✔	I	✔	✔			✔	None available
L	H	M	M	M	M	5-8		*Zelkova serrata* — Japanese zelkova	H	H	M		V				✔	✔	‘Autumn Glow’ (purple fall color), ‘Green Vase’ (vase-shaped; orange fall color; fast growth), ‘Variegata’, ‘Village Green’ (good growth rate)
M	H	H	H	M	H	6-9	4,5	*Zizyphus jujuba* — Chinese date	M	M	M		O			✔			‘Lang’ (fruits young), ‘Li’ (2" fruits)



OBTAINING TREES

Trees can be obtained from a number of sources including nurseries, garden centers, and by mail. Always try to work with a company you know and trust. Good dealers will have staff who are knowledgeable about trees and will provide good service. Guarantees are usually available from good suppliers – look for a one-year replacement guarantee if possible. As with most other purchases, you usually get what you pay for and if the price seems too good then the tree probably is not worth buying. Be especially careful if it looks like a dealer does not take good care of his/her plants – for example letting roots dry out, having many diseased or damaged plants, etc. – you may be buying a dead tree. Important points to consider in obtaining a tree are **tree health**, **tree size**, and **tree type**.

TREE HEALTH

In the nursery inspect the tree for signs of insect, disease, or major physical damage. Trees that have been severely pruned to "balance" their tops and root systems should be avoided, since this actually weakens the tree and may cause poor form later. Buds usually should be tightly closed since actively growing trees are easily damaged or killed by transplanting. Root balls should be firm and well-protected from sun and drying wind. A completely dry root system or potting soil is a sign of a neglected and possibly dead tree.

TREE SIZE

The size of a tree largely determines the amount of transplant shock it will experience, with larger trees generally experiencing more shock. This shock is mainly caused by root loss during transplanting – trees can lose 90 percent or more of their roots when they are dug – and results in smaller foliage for at least one growing season and reduced shoot length and diameter growth for several seasons. Recovery from transplant shock takes about one year for each inch of trunk diameter for an otherwise healthy tree. Minimize transplant shock by planting the smallest tree that accomplishes your purposes. Vandal-prone and high traffic areas may require larger trees to improve survival, though tall metal stakes also provide protection.

TREE TYPES

Landscape trees and shrubs can be obtained in four basic types or forms: **bare-root**, **balled-and-burlapped**, **container-grown plants**, and **tree-spaded**. Each type has its own advantages and disadvantages and none is ideal for all situations. With all four types be sure that you have an adequate root system – a good rule-of-thumb is that the root system, root ball, or container diameter or spread should be 10 inches to 12 inches for every inch of stem caliper (diameter at ground-line just above any basal swell). Therefore, a 3 inch caliper tree should have a 30 inch to 36 inch wide root ball as a minimum. Root ball depth is not as critical as width, but should be larger for larger trees.

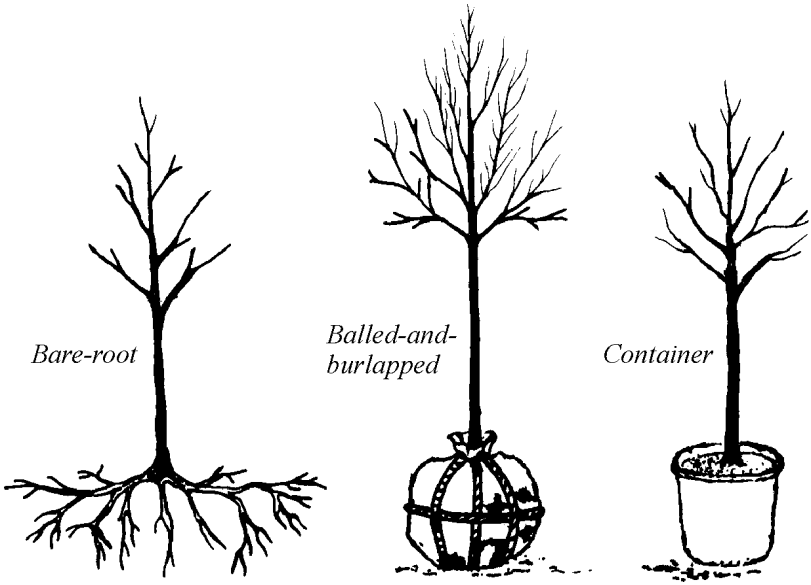
• **Bare-Root –** Bare-root plants are dug from a nursery with no soil around the roots. Though bare-root seedlings may have a fairly complete root system, larger landscape-sized plants usually only have a few coarse, woody roots attached. These plants have the advantages of being inexpensive and light weight. However, extra care must be taken to keep their exposed roots moist. They also may be very difficult to find and generally are only available in the spring before bud burst. Bare-root deciduous trees should have a caliper smaller than 2 inches and bare-root evergreens should be very small (less than 2 feet tall). Bare-root trees should be planted only when they are dormant and spring planting is best.

• **Balled and Burlapped –** Balled and burlapped (B&B) plants are dug from the nursery with a ball of soil intact around their roots. The root ball is tightly wrapped with burlap held in place with twine, nails, and possibly a wire basket. Both fine and coarse roots are contained in the root ball so transplant shock is reduced. Rough handling, though, breaks roots and makes them lose soil contact, so handle these trees with care. B&B plants are much more expensive than bare-root trees and are much heavier but generally have a better chance of survival. Tilling the soil just outside the root ball 8 to 12 inches deep and several feet wide right after planting is one way to ensure good root growth.

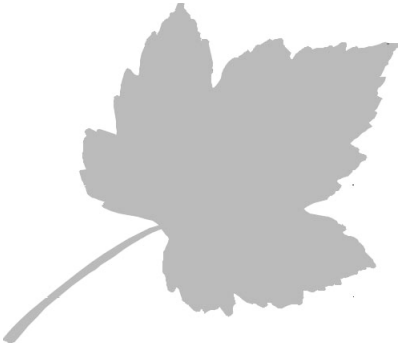
• **Container Plants –** Trees are sometimes grown and sold in pots for convenience and to avoid root loss during transplanting. Containers are made in a variety of materials (plastic, compressed peat, etc.) and sizes. Container-grown trees are normally more expensive and heavier than bare-root but less than B&B. Round pots can cause roots to circle which may cause girdling roots later in a tree's life. Such roots should be cut or straightened at planting time. Container trees should be well-rooted without being root-bound – avoid buying bare-root trees that have recently been potted and are not well-rooted. Such trees may transplant well, but are more expensive than they are worth.

• **Tree-Spaded –** A tree spade, a large machine that cuts roots and soil so the root ball can be wrapped, is often used to dig B&B trees in the nursery. Some landscape contractors also move trees to the site and transplant them into a previously dug hole with the tree spade. These trees can be treated similarly to a B&B tree,

but be sure that the gap between the root ball and the hole is closed so roots can grow out. Tilling around the root ball, as mentioned under B&B trees, is a good way to ensure good contact between the root ball and soil.



Trees can be obtained from nurseries and garden centers as bare-root stock, balled-and-burlapped stock, container-grown, or tree-spaded (not shown).



TREE PLANTING

Tree planting consists of preparing a planting site, placing the tree, and backfilling, as well as some post-planting follow-up care. The following discussion refers to all four types of trees (bare-root, B&B, container, tree spaded). Soil conditions are very important in the planting process, so we will summarize some important soil conditions and how they can be modified.

SOIL CONDITIONS

As mentioned previously, important soil conditions to consider for tree health are **texture**, **drainage**, **compaction**, **pH**, **salinity**, and **structure**. All of these conditions can be modified to some extent. However, when soil conditions cannot be adequately modified, or modification is too expensive, tree species and cultivars often can be selected that are tolerant of extremes.

• **Soil Texture –** Soil texture is the proportion of sand, silt, and clay particles in a soil. Sand particles are large and coarse, silt is smaller, and clay particles are very small. Ideal soils for root growth tend to have a mixture of all three particle sizes and are called loams. Such soils have good water and mineral nutrient (element) holding capacity because of the silt and clay, and good drainage, porosity, and air movement because of the sand. Very clayey soils tend to waterlog and are hard for roots to grow through. Sandy soils may be droughty and low in mineral content. Soil texture is not easy to change but it is good to be aware of.

• **Soil Drainage –** Drainage refers to how quickly a soil drains after water is applied and is affected by texture, structure, porosity, precipitation or irrigation levels, and the slope and landscape position of a site. Soils can be excessively drained, well drained, or poorly drained. Excessively drained soils tend to be coarse textured (sandy) and drain too rapidly to be able to supply much water for plants. Poorly drained soils usually are fine textured (clayey) and hold water too long which limits soil oxygen. Excessively drained soils can be improved by addition of organic matter or by bringing

in new soil. Poor drainage can be improved with drain tiles or other artificial drainage systems. Special planting methods can also be used to deal with poor drainage.

• **Soil Compaction –** Good soils for root growth are made up of about one-half soil particles and one-half pore space. Soil compaction occurs when a soil is compressed enough to reduce pore space, decreasing root growth and soil oxygen levels. Vehicle and pedestrian traffic, construction activities, and working of wet soils all increase compaction, especially in fine soils. Severely compacted sites, like old parking lots, construction sites, or walkways, may need to be deeply tilled over the entire site before trees are planted. Local compaction can be reduced or prevented with mulch beds and traffic control. Augering 2-3 inch diameter holes 8-16 inches deep in a grid around a tree reduces compaction. Holes should be left empty and allowed to collapse, or can be filled with compost or other coarse organic material (called vertical mulching). Avoid augering into large roots by staying away from the soil near the trunk. Research has shown that systems that inject air below the soil surface have little or no effect on compaction. Core aerators reduce compaction but only very near the soil surface.

• **Soil pH –** Soil pH or reaction is the acidity or alkalinity of a soil and is a good indicator of the availability of many mineral nutrients (elements). Seven is a neutral pH with lower numbers being acidic and higher numbers alkaline or basic. Trees generally do best in a slightly acidic soil with a pH of 5 to 6.5. Below and above this range certain minerals become less available. High soil pH's (alkaline soils) are common in Utah, causing problems with availability of iron and manganese for trees. Researchers have lowered soil pH with regular additions of granular sulfur, but this may be impractical if the pH is very high and if the soil is very fine. Sulfur applications may damage turf, but such damage can be prevented by applying the material to a mulch bed under the tree. A mixture of sulfur and ferrous sulfate can be placed in augered holes to locally reduce soil pH. Iron chelates also can be used to provide iron in high soil pH situations, but they are very expensive and do not last long (see *Control of Iron Chlorosis*, AG SO01, a fact sheet available through your Extension office or at www.ext.usu.edu/publica/agpubs/agso01.pdf).

• **Soil Salinity –** Salinity refers to the relative amount of salts in the soil. Saline soils have high accumulations of sodium, chloride, and certain other ions. These ions interfere with nutrient and water uptake, reduce growth and alter plant metabolism, and can cause increased soil compaction. Utah has large areas of naturally saline soils and areas that are becoming saline because of salts present in irrigation water, combined with over-irrigation. Localized areas can also become saline due to runoff of deicing salts along roads and sidewalks. Such salts may also be deposited directly on above-ground plant parts. Salts can be leached out of well drained soils if the salinity is mild and the irrigation water is fairly salt-free. Planting salt-tolerant trees may be the only choice if salinity is very high.

• **Soil Structure** – Structure refers to the arrangement of soil particles into granules, clods, or other forms with spaces in between. Loose, granular soils are good for trees because air, water, and roots easily penetrate the many spaces in the soil. Hard, dense, cloddy soils have little room for roots to grow or oxygen and water to penetrate. Good soil structure may be ruined by working or disturbing the soil while it is wet. Though poor structure may improve over time through the action of soil microbes and freezing and thawing, deep tillage is the only way to quickly improve soil structure (do not till around established trees). Addition of organic matter at planting time may improve soil structure, but should be avoided in all but the worst cases since roots must eventually grow into the surrounding native soil. If soil conditions are that bad, changes should be made or trees should not be planted.

• **Soil Testing** – Soils tests for mineral content, pH, and other characteristics can be done through commercial labs or through Utah State University's Soils Testing Laboratory, Utah State University, Logan, UT 84322-4830. Contact your Extension office for directions for gathering and transporting samples or obtain the fact sheet *Soil Testing Guide for Home Gardens*, HG H05 (www.ext.usu.edu/publica/gardpubs/hfs05.pdf). Be sure that you have several samples analyzed separately if you think that your landscape differs from one area to another.

PREPARING THE PLANTING SITE (DIGGING THE HOLE)

Dig your planting hole much wider than the root ball with sloping sides; a hole at least three times the root ball width is best (see diagram). The hole should be just deep enough so the bottom of the root ball will be placed on undisturbed soil and the root collar will be at or above the level of the surrounding soil. The root collar is a flared or swollen area on the trunk where the root system and trunk meet and where the soil contacted the trunk in the nursery. Loosening the soil in the bottom of the hole has been recommended in the past but this lets the heavy root ball settle and sink, causing the tree to be too deep. A small indentation can be made in the bottom of the hole to stabilize large root balls. If the sides of the hole become glazed during digging, open up the soil's pores and cracks with the tip of a spade or a trowel to increase root penetration.

PLACING THE TREE

Place the tree in the bottom of the hole onto undisturbed soil with its stem vertical. Handle the tree by its root ball or container to avoid trunk damage. Never drop the tree or you will loosen the root ball and break roots. Make sure that the root collar is at or above the surrounding soil grade.

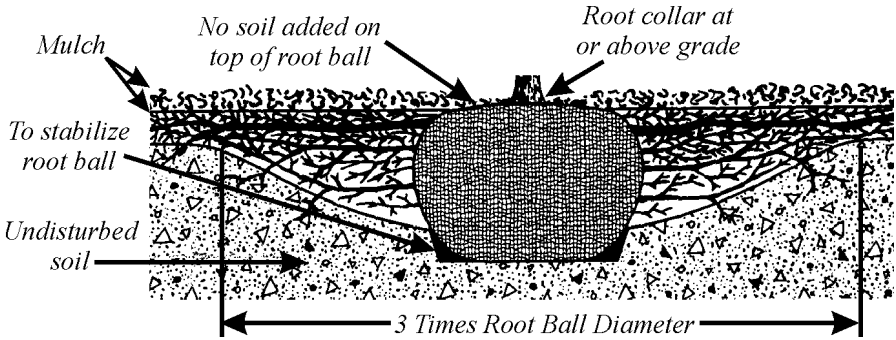
Now start to remove packing materials from the root ball. Ropes and wires that surround the trunk or root collar should always be removed or they will eventually girdle the tree. Roots must quickly grow from the root ball into the surrounding native soil for the tree to survive. Though untreated burlap breaks down fairly quickly in the soil, treated burlap and some types of pots break down too

slowly to assure good, quick root growth out of the root ball. Therefore, if the root ball or potted root system is strong and firm all packing materials should be removed, including pots, wire baskets, and burlap. If the root ball is broken and loose remove these materials carefully and only to the extent that you can keep the root ball together. Backfilling as you remove these materials helps keep the root ball intact. Any burlap or potting material that must be left on should be slit in several places to allow roots to grow through. It is less important but still desirable to remove packing materials left underneath the root ball. Cleanly cut any circling or damaged roots that are exposed at this point to promote good root growth.

Bare-root trees should be placed with their root collar positioned as mentioned above and with their root system spread out in the flat-bottomed hole or over a shallow mound constructed in the bottom of the hole. Do not bend or kink roots to make them fit. If roots are too long for the hole either dig the hole wider and deeper or, as a last resort, cut off some root length with sharp hand pruners. Also cleanly cut any crushed, torn, or otherwise damaged roots.

BACKFILLING

Fill the hole with the original native soil – this is the soil the tree must ultimately move its roots into to survive. Large rocks can be removed when backfilling. Up to 25% by volume of composted organic matter can be mixed in with the backfill soil if it has a very high clay content and is difficult to work, but in such cases till the soil just outside the root ball 8 to 12 inches deep and several feet wide after planting to ensure good root growth. Otherwise use no other soil amendments. Polyacrylamide gels (water absorbing polymers) added to the backfill at planting time have been shown to have no significant effect on tree survival or growth.



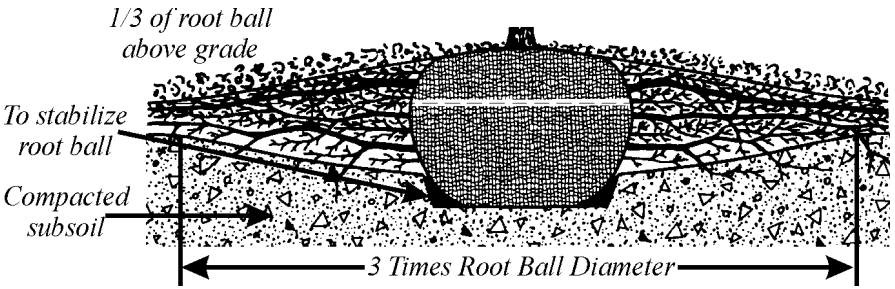
The planting hole should be shallow and wide to allow for rapid root growth after planting. Planting trees too deep is a common problem.

Break up large clods as you backfill and pack the soil occasionally to remove air pockets. Pack the soil with your hand or lightly with your foot to avoid over-

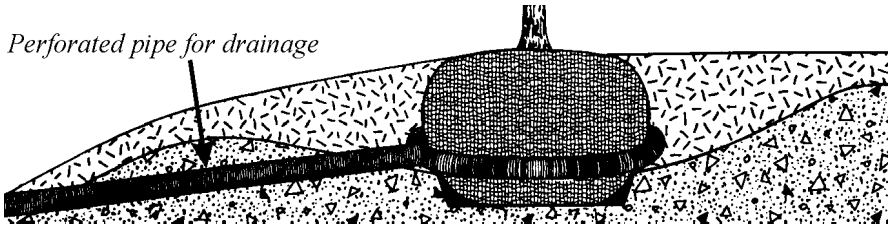
compaction. Straighten the tree and keep its root collar at the right level as you backfill. Add and pack the soil until it is even with the surrounding soil level and the root collar. If you are purposely planting the tree shallow, mound the soil up to the root collar (bare-root) or to cover the sides of the root ball. No roots should be exposed when backfilling is complete and no soil should be put on top of existing root balls. Water well immediately after backfilling to help settle the soil and remove air pockets. Place additional soil where settling occurs, but no packing should be done after the soil is wet.

PLANTING WITH POOR DRAINAGE/COMPACTION

Poor drainage can and should be improved if possible by grading or installing drain tiles to carry water away (see diagram). On flat sites or sites with moderate drainage or compaction problems trees can be planted shallow, with one-third or more of the root ball above grade and the backfill soil mounded up to cover the root system. Trees can even be placed on top of the existing soil with their roots in a mound or berm. Such trees may do well but also may have a fairly small root system and will need more care and attention than trees on better sites.



Where adequate drainage is a problem, either elevate part of the root ball above grade and gradually slope the soil around it (see above) or provide a drain to a lower point (see below).



SEASON TO PLANT – Trees are best planted when they are still dormant with tight, unopened buds in the early to mid-spring after the soil has thawed. Moderate temperatures and good soil moisture in the spring help trees get established. Fall planting also works well for many species, though watering will be critical if the fall is dry. Summer planting of B&B and container plants can be done

successfully, though hot temperatures, dry conditions, and non-dormant trees make good care especially important and survival less sure. Bare root trees should only be planted in spring while still dormant.

FOLLOW-UP MAINTENANCE

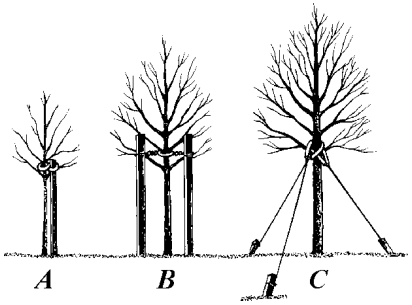
• **Watering –** Up to 95% of a tree's roots are cut off during transplanting, greatly decreasing its ability to take up water. Water, therefore, is a tree's greatest need at planting time and for a year or two after transplanting until a good root system is established. Thoroughly water newly planted trees, applying the water with a hose or bucket to the entire planting area and letting it soak in well. Fill any holes that open due to soil settling but do not pack the wet soil.

Watering needs after planting depend on weather, drainage, planting season, and the species you have planted. Though water should be applied to the original planting area and root ball, it should also be applied to the soil surrounding the hole so roots can grow out. Apply water often enough so the soil near the tree at least several inches below the surface is moist and will form a ball when squeezed. If the soil crumbles it is too dry. Water will be needed every two to four days as the tree is getting established in its first summer. A soil probe or rod with a rounded tip can be used to indicate soil moisture. The rod will penetrate the soil with more resistance as the soil drys. Remember, it is possible to over-water a tree, especially in poorly drained soils. Do not water so often or so deeply that the tree's root system becomes waterlogged. Older, established trees can withstand some soil drying around their root systems, but all landscape trees should be watered regularly during periods of severe drought.

• **Fertilizing –** No fertilizers of any kind should be used at planting time since they can decrease root growth and may cause the crown to outgrow the roots. No hormones, extracts, vitamins or other such formulas have been shown to stimulate root growth or help tree establishment. Fertilizing should only be done after the tree has recovered from transplanting, and then only if needed. This recovery can take two or three years; longer with larger trees.

• **Mulching –** A bed of wood chips or other coarse organic mulch around a tree's base greatly increases root and tree health. Maintain a mulch bed around all newly planted and existing trees that extends several feet from the trunk; the farther the turf is away from the trunk the better. Mulch should be 3 to 4 inches deep and should be renewed as it breaks down. Keep the mulch a couple of inches away from the base of the trunk to avoid root or trunk decay and rodent burrowing and damage. Air tight plastic sheeting and rock beds should not be used around trees. Porous weed barriers of woven or matted plastic provide effective weed control but can be difficult to install and maintain and are not much more effective than an adequate organic mulch layer.

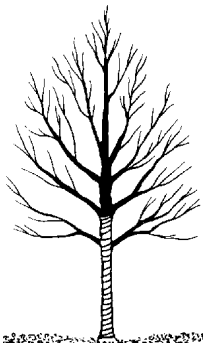
• **Staking –** Stake newly planted trees only where wind is a problem. Guy loosely to allow some stem movement, using canvas strapping or similar materials around the tree to prevent trunk damage. Remove all staking materials after one or two years. In heavily used areas the presence of a couple of tall stakes helps to physically protect the tree even if no guying materials are used.



Staking varies with tree size. Use one stake for trees up to 2" in diameter (A), two stakes for trees 2-4" in diameter (B), and at least three stakes for trees over 4" in diameter (C). Wires can be used, but materials that contact the tree should be soft and flexible, like canvas webbing or rubber straps.

• **Trunk Protection –** Thin bark on lower trunks of young trees sometimes is damaged by "sunscald." This damage appears as small cracks or wounds on the bark, especially on the southwest side of the tree. Though the underlying cause is uncertain, sunscald appears to be caused by bark being warmed by the winter sun, becoming less cold-hardy, and then being damaged by freezing when the sun sets. Tree wrap made from corrugated paper or a similar material is often used to help prevent this. However, research has shown few if any benefits to wrapping most trees. In fact, tree wrap may improve conditions for insects and diseases that damage tree trunks, it decreases the young bark's ability to make food through photosynthesis, and it has been shown to *increase* rather than decrease bark temperature fluctuations.

Trunks of newly planted trees can be protected with special tree wrapping paper. The paper is wrapped in overlapping layers starting at the bottom and working up to the branches.

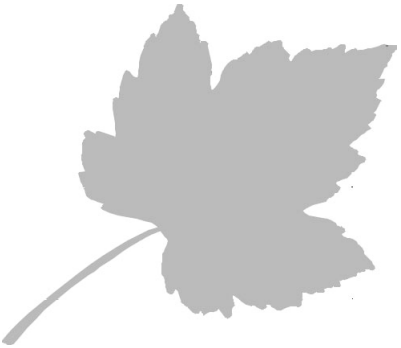


If you choose to wrap your new tree, wrap from the trunk base to one-half of the way up the trunk, overlapping as you go and using masking tape to hold the wrap at the top. Apply wrap in the fall after leaf drop and remove each spring, repeating for no more than two or three years after planting. Do not wrap trees with trunks that will be shaded in the winter. Damage from feeding of rabbits and mice can be prevented by wrapping wire mesh around lower stems of young trees. Remember to remove or reposition the mesh before it girdles the tree. Plastic tree shelter tubes have been shown to be of some benefit to growth and survival of young trees, but further research is needed to prove their worth and to improve the guidelines on how they are used. If they are used remove them after the first year.

• **Pruning –** Little pruning should be done at planting time because the young tree needs all of the stored food (in the wood) and food making ability (in the leaves) it can get. Trees should not be "headed back" at planting time to "balance" the roots and crown. The tree will naturally lose branches or twigs if "balance" is needed. These branches will die, at which time they can be removed. Dead, diseased, damaged, or rubbing branches should be removed at planting time. Once the tree is established it becomes important to begin pruning to ensure good form later in life.

• **Weed Control –** Weeds use water and mineral nutrients that would otherwise be available for your newly planted tree. Some grasses are especially heavy water users and should not be allowed to grow near young trees. Control weed competition by using a wide mulch bed several inches deep and by pulling weeds or using directed sprays of herbicides as needed. Herbicides or weed killers that are taken up by roots should not be used since they can harm the tree. Glyphosate (Roundup) is an effective weed killer that can be sprayed on leaves of weedy plants without affecting trees growing nearby. Keep all weed killers off of tree leaves, young bark, and sprouts coming from the tree base.

Weed whips or string trimmers *should not* be used around trees since they can easily damage trunks and roots. Plastic protective devices often are placed around lower trunks so mowers and string trimmers can be used close to trees, but these devices *do not work.*



FOR MORE INFORMATION

There are many good sources of information, including your local Cooperative Extension office, the library, your local nursery or garden center, or a local arborist. Be sure that your source of tree information is up-to-date and is familiar with the latest research on landscape trees. Much of what was recommended for trees in the past has turned out to be unnecessary or even harmful to trees, so remaining current is very important. For general information related to landscape trees or community forestry contact the Utah Community Forest Council, Box 961, Salt Lake City, Utah 84110-0961.

ACKNOWLEDGMENTS

Some of the drawings in this booklet are from "Selecting & Planting Trees" published by the Morton Arboretum, Lisle, Illinois, and are used with their permission. Thanks to Dr. Roger Kjelgren at USU for his review of this second edition.

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